JET PROPULSION LABORATORY INTEROFFICE MEMORANDUM

March 10, 2003

TO: G. Burke

FROM: S. Lineaweaver

SUBJECT: Mars Odyssey Extended Mission Loading Study

The Resource Allocation Planning and Scheduling Office (RAPSO) performed a loading study to determine the impacts of the Mars Odyssey (M01O) extended mission tracking requirements on the Deep Space Network (DSN) and the ability to support those requests.

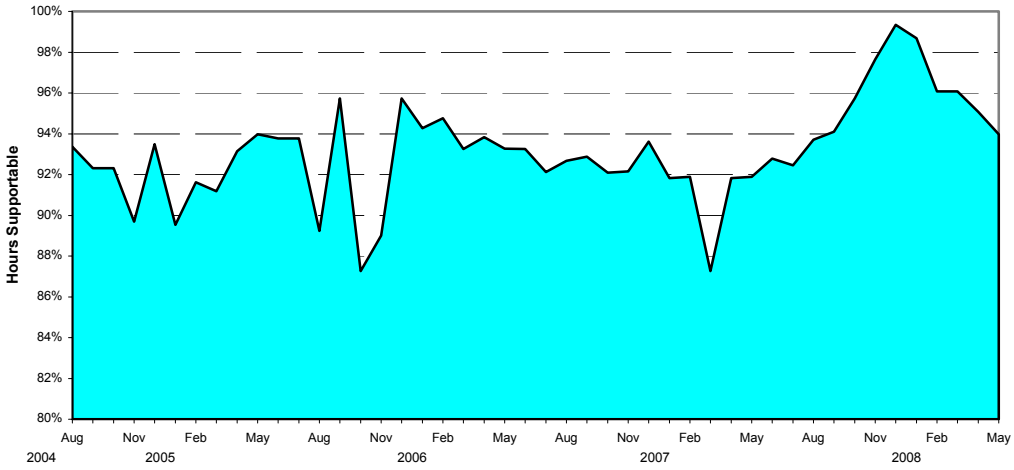
Analysis was accomplished using the FASTER (Forecasting And Scheduling Tool for Earth-based Resources) forecasting system, the Mars 6-degree-mask view period, and the updated mission set database from the February 2003 Resource Allocation Review Board (RARB).

Mars Odyssey extended mission requirements begin on August 25, 2004 and continue until May 29, 2008. The weekly request is for 70 hours of DSN tracking from 70 or 34-meter X-band antennas. Support from the 70-meter Subnet is preferred due to the increased downlink gain and resulting telemetry bit rate available for the mission when tracking with a 70-meter antenna. This study addresses Mars Odyssey extended mission requirements forecast on the 70-meter Subnet except where agreements to use 34-meter support are in place as a result of RARB negotiations and agreements. See the attached User Loading Profile for weekly requirement, multiple spacecraft per antenna (MSPA) usage, and resource distribution.

Figure 1 shows the forecast monthly supportable percentage of requested time for the duration of the extended mission. Mars Odyssey should expect to receive on average 85 to 90% of the time requested on the 70-meter Subnet except when supportable time declines to about 80% in August and October/November 2005 and again in March of 2007.

In August 2005 downtime at DSS-43 is approved causing 70-meter users to be supported at DSS-14 or DSS-63 only. The Mars Odyssey request for seven 10-hour passes is in contention with several other DSN users requests for support. In week 31 Cassini tour requires four 9-hour passes, DSS Maintenance requires 2 periods of preventative maintenance at DSS-14 and at DSS-63, Goldstone Solar System Radar requires five 4 to 6-hour passes at DSS-14 for Asteroid 1992UY4 observation, Mars Express requires one 4-hour bi-static radio science pass and Nozomi requires three 3-hour radio science passes. Mars Express and Nozomi support may be combined (MSPA) with M01O support. The Cassini, DSS Maintenance, and Asteroid 1992UY4 view periods overlap about 50% into the Mars view period.

Figure 1. 2001 Mars Odyssey Extended Mission
Monthly Supportable Percentage of Requested Time



In October/November 2005 DSS-63 downtime is approved which causes 70-meter users to be supported at DSS-14 or DSS-43. Contention is primarily at DSS-14. The Mars Odyssey request for seven 10-hour passes is in contention with requests supporting Goldstone Solar System Radar Mars observations and Cassini tour at DSS-14. The Mars Canberra view period is about 9 hours in duration. To utilize the Canberra viewperiod to satisfy the M01O hourly request some tracking time from DSS-14 is needed and causes contention with the support requested for the other users at the Goldstone complex.

In March 2007 the New Horizon Jupiter flyby is planned and New Horizons requests continuous 70-meter tracking for six days in weeks 10 and 11. Mars Odyssey has contention with the New Horizons request and with the 5 to 6 periods requested for preventative maintenance on the 70-meter Subnet.

A period of concern is in September 2007 when loading in the Mars view period on the 34-meter Subnet is significant. Mars Competed Scout is requesting continuous support for their launch and early orbit phase. Support is also requested for Mars Global Surveyor, Mars Reconnaissance Orbiter, and STEREO Ahead to name a few. Mars Odyssey requirements are forecast above 90% on the 70-meter Subnet however the numbers forecast in this preliminary assessment may be affected as user's requirements are offloaded from the 34-meter antenna. MGS or MRO support combined (MSPA) with Mars Odyssey may help to resolve contention with the Scout mission.

We believe that Mars Odyssey can achieve nearly all of the requested support with minimal impact to other users for most of the extended mission. Some support on the 34-meter Subnet or MSPA with other missions at Mars may be needed to resolve contention in the periods detailed above. Overall, our preliminary estimates are that Mars Odyssey should receive in excess of 85 to 90 % of the requested support and may successfully improve that amount with careful scheduling and the use of the MSPA capability during periods of high activity.

As always, the results of this study are preliminary in that network loading changes as requirements for planned missions are input and updated. We will continue to work with Mars Odyssey and other users of the DSN to maximize the time available for each individual user.

cc:
A. Andujo
B. Arroyo
E. Hampton
N. Lacey
D. Morris
R. Bartoo
J. Valenci

7-Mar-03

User Loading Profiles

Concurrence: ______________________

Project Manager Date

2001 Mars Odyssey

VP			Durations		Calibration				January					February			March				April					May				June					July				August				September					October				November					December		
Object	User	Resource	Ave	Min	Pre	Post	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
2004																																																												
M01O	M01O Map/MER1 D/L	70M	8.0	4.0	1.50	0.25					7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	2																												
M01O	M01O Map/MER2 D/L	70M	8.0	4.0	1.50	0.25		7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	2																																			
MEXP	M01O Map/MEX R/S	DSS-63	7.0	4.0	2.00	0.25																													1	1	1																						
M01O	M01O Map/MGS Map	70M	10.0	4.0	2.00	0.25																																																				2	2	3	2	2	3
M01O	M01O Mapping	70M	7.0	4.0	0.50	0.25																											9																										
M01O	M01O Mapping	70M	4.0	4.0	0.50	0.25																										3	3																										
M01O	M01O Mapping	70M	8.0	4.0	0.50	0.25	3	14	6		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	9	7	7	7		7																												
M01O	M01O Mapping	DSS-43,63	7.0	4.0	0.50	0.25																								5		11		9				13	11																				
M01O	M01O Mapping	DSS-43,63	8.0	4.0	0.50	0.25																													7	10	10																						
M01O	M01O Mapping	DSS-43,63	5.0	4.0	0.50	0.25																												1	2	1	1																						
M01O	M01O Mapping	70M	6.0	4.0	0.50	0.25	1																																																				
M01O	M01O Mapping	DSS-14,43	4.0	4.0	0.50	0.25																								4																														
M01O	M01O Mapping	DSS-43	7.0	4.0	0.50	0.25																																		6	4																		
M01O	M01O Mapping	70M	10.0	4.0	0.50	0.25																																																		5	5	4	5	5	4
M01O	M01O Mapping	DSS-43	10.0	4.0	0.50	0.25																																			2	5	5	4	5	5	4	5	4	4	4	4	4						
MEXP	MEX Sol Cor/M01O	DSS-63	8.0	4.0	2.00	0.25																																		5	3	2	2	2	2														
MEXP	MEX Sol Cor/M01O	DSS-63	7.6	4.0	2.00	0.25																																								2	3												
MEXP	MEX Sol Cor/M01O	DSS-63	6.5	4.0	2.00	0.25																																														3	3						
MEXP	MEX Sol Cor/M01O	DSS-63	6.0	4.0	2.00	0.25																																		2																			
MEXP	MEX Sol Cor/M01O	DSS-63	7.0	4.0	2.00	0.25																																										3	3	3	3								
M01O	M01O Mapping	DSS-45,65	7.0	4.0	0.50	0.25																												2	2	2	2																						
M01O	M01O Mapping	34H	7.0	4.0	0.50	0.25																											2	2																									
M01O	M01O Mapping	DSS-15,45	7.0	4.0	0.50	0.25																																1	1	1																			
M01O	M01O Map/MGS Map	DSS-25,34,54	8.0	4.0	2.00	0.25	2																																																		
M01O	M01O Mapping	DSS-25,34,54	8.0	4.0	0.50	0.25	8		4	12																																															
M01O	M01O Mapping	DSS-25,34,54	6.0	4.0	0.50	0.25			1																																																
M01O	M01O Mapping	DSS-25,34,54	2.0	2.0	0.50	0.25				1																																															
M01O	M01O Mapping	DSS-55	12.0	4.0	0.50	0.25																																	1																				
M01O	M01O Mapping	DSS-55,63	12.0	4.0	0.50	0.25																																	1																				
2005																																																												
M01O	M01O Map/MGS Map	DSS-14,63	10.0	4.0	2.00	0.25																																				3																	
M01O	M01O Map/MGS Map	70M	10.0	4.0	2.00	0.25																																													1							
M01O	M01O Mapping	70M	10.0	4.0	0.50	0.25	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7								7								7	6	7	7	7	7	7	7	
M01O	M01O Mapping	DSS-14,63	10.0	4.0	0.50	0.25																														7	7	7	7	7	7	4																	
M01O	M01O Mapping	DSS-14,43	10.0	4.0	0.50	0.25																																						7	7	7	7	7	7	7									
2006																																																												
M01O	M01O Map/MGS Map	70M	10.0	4.0	2.00	0.25	3	3		3						3	3						3					4			3	3					3	3	3	3	3	3	3		3										3	3	3	3	
M01O	M01O Map/MRO PrSci	DSS-43	10.0	4.0	2.00	0.25																																													3	3	3	3					
M01O	M01O Map/MRO PrSci	70M	10.0	4.0	2.00	0.25																																																	3	3	3	3	
M01O	M01O Mapping	70M	10.0	4.0	0.50	0.25	4	4	7	4	7	7	7	7	7	4	4	7	7	7	7	7	4	7	7	7	7	3	7	7	4	4	7	7	7	7	4	4	4	4	4	4	4	4	4										1	1	1	1	
M01O	M01O Mapping	DSS-43	10.0	4.0	0.50	0.25																																								4	4	4	4	3	2	1	1	1					
M01O	M01O Mapping	DSS-43	6.0	4.0	0.50	0.25																																												1									
M01O	M01O Mapping	DSS-63	4.0	4.0	0.50	0.25																																												1									
MEXP	MEX R/S/M01O Map	DSS-14,63	10.0	4.0	2.00	0.25																																								3	3	3	3	3	2	3	3	3					
2007																																																												
M01O	M01O Mapping	70M	10.0	4.0	0.50	0.25	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
2008																																																												
MAR6	M01O Mapping	70M	10.0	4.0	0.50	0.25	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	4																															